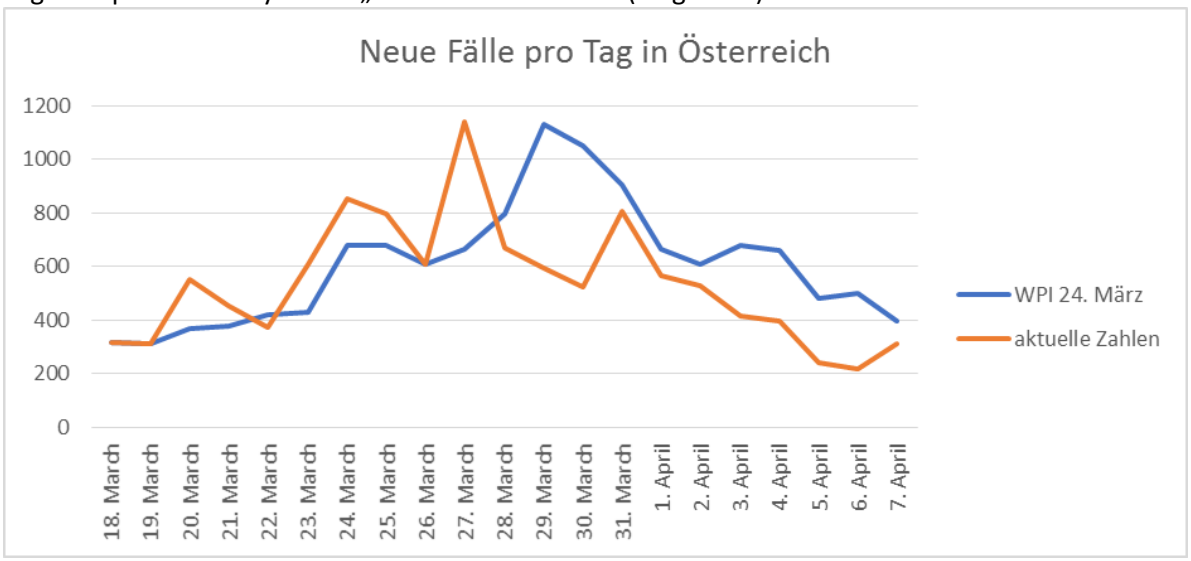
.

Update 7. April 2020: **“Lock-down in Austria appears as more efficient than in Wuhan.**
“Quantitative” easing of „measures“ is possible, if same „quality“.

The (“data driven”) “WPI Analog Computermodel” = “rescaling + shifting” the full data from China.
Model and prediction finalized 23 march, published on www.wpi.ac.at on 26 march 2020;
prognosis period 60 days since „lockdown in Austria“ (diagram 3)



.

Diagram 1: situation 7 april 2020: the “GrossGlocknerKurve” shows the prediction of the WPI Analog-Model (blue) compared to the daily case numbers as observed (orange).

The blue curve in diagram 1 is computed from a slightly modified model: heuristic combination data from China and Italy for a prediction until 7. april, i.e. around the expected “peak” end of march.

1) **The “peak” of 1160 cases was predicted for 29 march,**
   indeed, the peak occurred a bit earlier with 1141 cases on 27 march.
2) **Ever since the “peak” the number of daily cases decreases non-monotonously,**
   clearly faster than in China (see page 2).
3) **The total number of cases - during this (first) lock-down - will stay below 17 000, the number computed with WPI Analog Model on 23 march as the upper bound. We see that Austria is ~ 10 % below Wuhan, so the number should be 15 300 until end of april.**
4) **Also the “number of deaths” will stay clearly below the number in China (diagram 5a).**
5) **The number of covid-19 required intense-care hospital beds will stay below the number of 850 computed with WPI Analog Model on 23. march as the upper bound.**
6) **If the „lockdown“ in Austria would have been decided 2-3 days later, Austria would probably have run in a situation like in Italy, Spain,…**

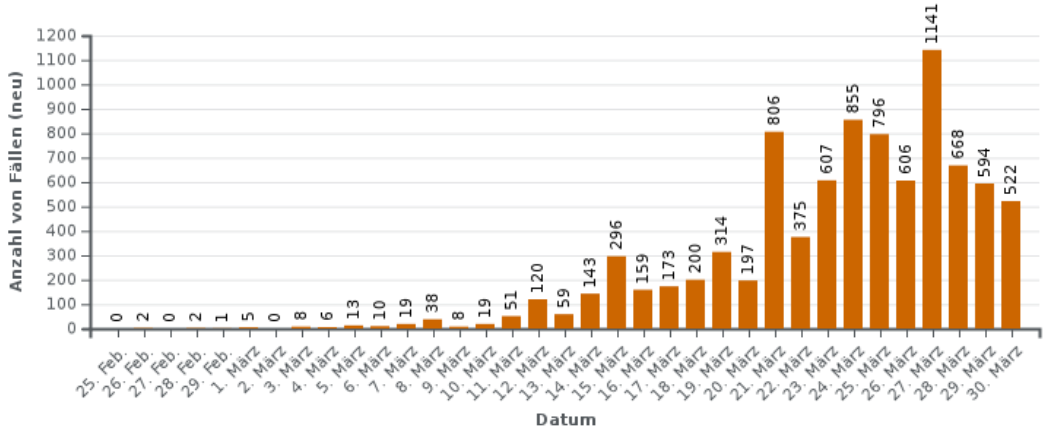


Diagramm 2: number of new cases per day in Austria around the “peak”.

Source: https://de.wikipedia.org/wiki/COVID-19-Pandemie_in_%C3%96sterreich

.

Prognosis of the WPI "Analog ComputerModel"

We use publicly available data like new cases per day, number of deaths per day (being aware of uncertainty in this data): a) the full data set for a lock-down of 60 days from Wuhan/China and b) the partial data set from Italy (and Spain), for a prediction for Austria, where the rescaling factor 0.3 was empirically determined from the first days. (Note that we operate with the measured case numbers only, so our model does not include "dark figures" of infected persons.)

This "modelling by analogy" allows for a precise long term prognosis for 60 days. It turns out that the predictions of 23 march are very reliable, e.g. the "peak" was predicted with a precision of 1 % (1160 for 1141) for end of march.

The diagram below is a comparison of the Austrian curve: in red the WPI computation until 24 march, then in orange the daily cases 24.3. –53.4, with the black curve being China rescaled by a factor 0.3.

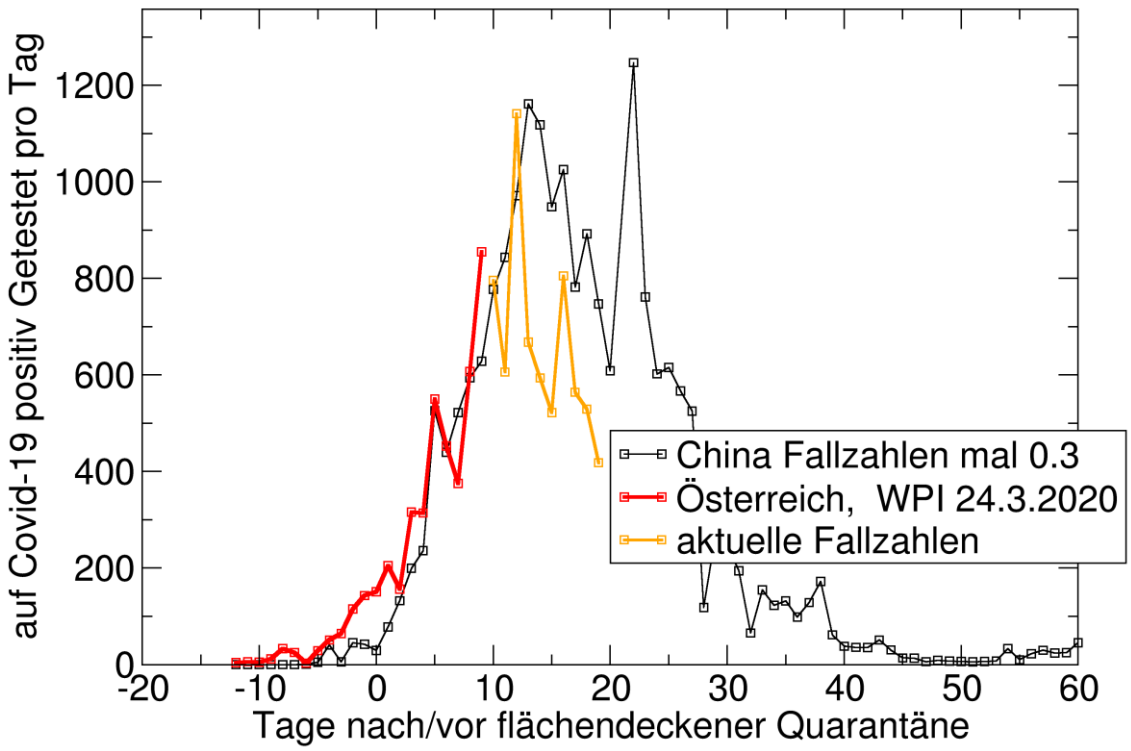


Diagram 3: the black curve is the "GrossGlocknerKurve in pure form", produced with the mere data from China by rescaling and shifting to the start of the lock-down, plotted for 60 days.

The version in Diagram 1 is a more complex version where the existing data in Italy is used, too, which yields a quantitative improvement within the same qualitative prediction.
ATTENTION: the second, even higher peak in China about 10 days after the 1st peak is not relevant, since it stems from a change in the counting/testing of cases in China, since from 19 feb. on also persons were added in the statistics who were clinically tested for Covid-19.

.

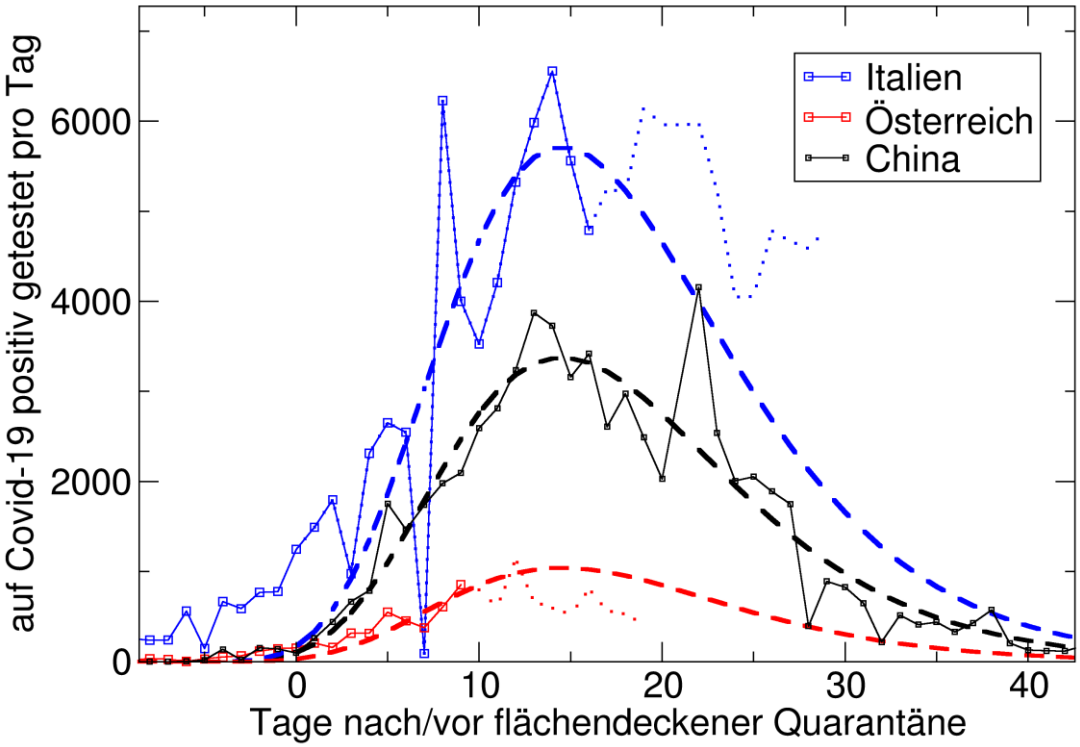


Diagram 4: the "full GrossGlocknerKurve" as a long term prediction for Austria (red) produced from the complete data in China (black) and the partial data in Italy (blue),
After rescaling and shifting to the start of the "lock-down".
The long dashes lines - - -, - - - ,- - - are the „fitted" versions of the continous lines of data points.
The point lines . . ., . . . , . . . are the daily new cases since the computation of our prognosis on 23.3.

The red point line of the measured cases in Austria is clearly below the prediction. This indicates that the lock-down in Austria works even better than in Wuhan.

The blue point line of the measured cases in Italy is clearly above the prediction. This indicates that the lock-down in Italy is less efficient than in Wuhan.

The power of the WPI "Analog ComputerModel" is it's „data driven" approach to fully use the available valuable information from the 2 „experiments" in China and Italy. These computations allowed an optimistic assessment of the Austrian "measures" as soon as 24 march. Together with sound insight e.g. into the efficiency of "masks" we thus could propose a) a sharpening of the measures by the obligation for wearing masks to enhance the effect of "distance" b) a "quantitative easing" of the lockdown in order to minimize the damage to people and economy, especially SMEs.

In some sense we used 47 million real „agents"in Hebei-Wuhan China for a "data driven" ("regression") "Analog model" that allows serious long term predictions. A good „Agent Based Model" (ABM) could do complementary short term predictions on a „microscopic level", or a „network model". In particular models like ABM and "Mean field models" should allow to quantify details of "measures" e.g. distance 2m vs 1m) and compute R_eff(t,x) as a time and space dependent "reproduction coefficient" (if ones likes this catch-word). Again, the WPI Analog model would allow predictions for Austria based on the comparison with countries where such refined measures are implemented.

.

WPI „Analog ComputerModell“ : <u>Comparison of „death rates”</u>

The following 4 diagrams compare the number of deaths per day in China (rescaled by the factor 0.3) with Austria red-orange, Italy blue-orange , Spain green-orange und France violet.

Austria is clearly below China also for the death rate, Italy above initially; Spain initially exactly on the Chinese curve, then increasingly above, France initially above, then in line, then significantly above.

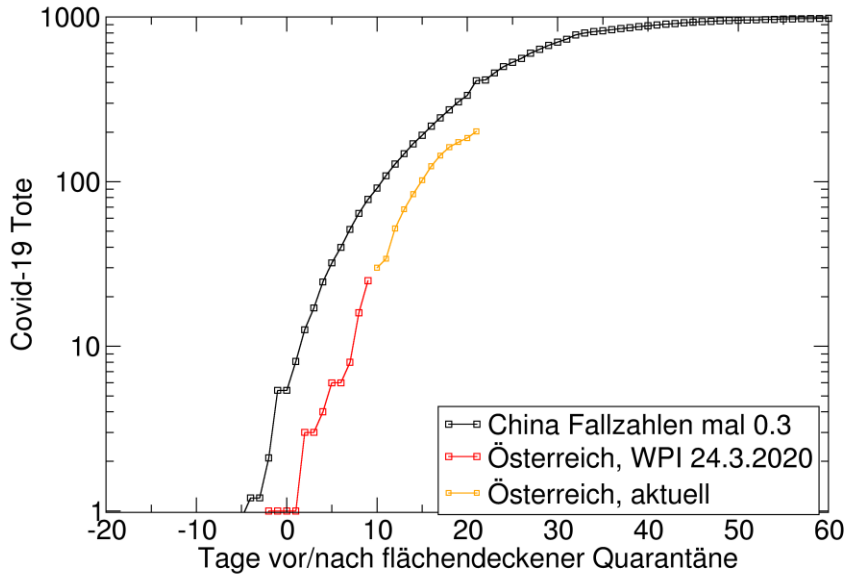


Diagram 5a: number of deaths/day China vs Austria

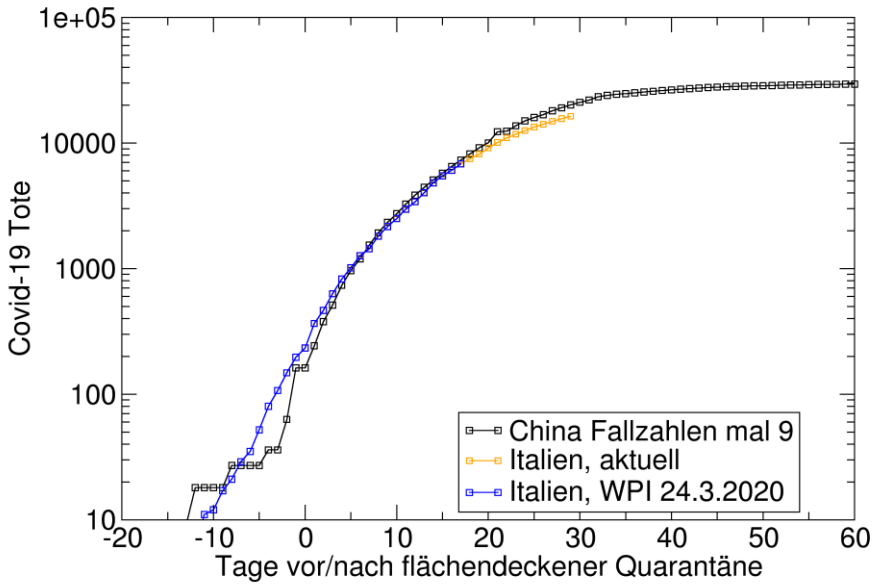


Diagram 5b: number of deaths/day China vs Italy

.

Below two diagrams for a comparison of China with Spain and France.

We note an interesting pattern in all the curves, with a striking similar shoulder that reminds (polynomial) “scaling laws”; further investigations, with several models, should be performed.

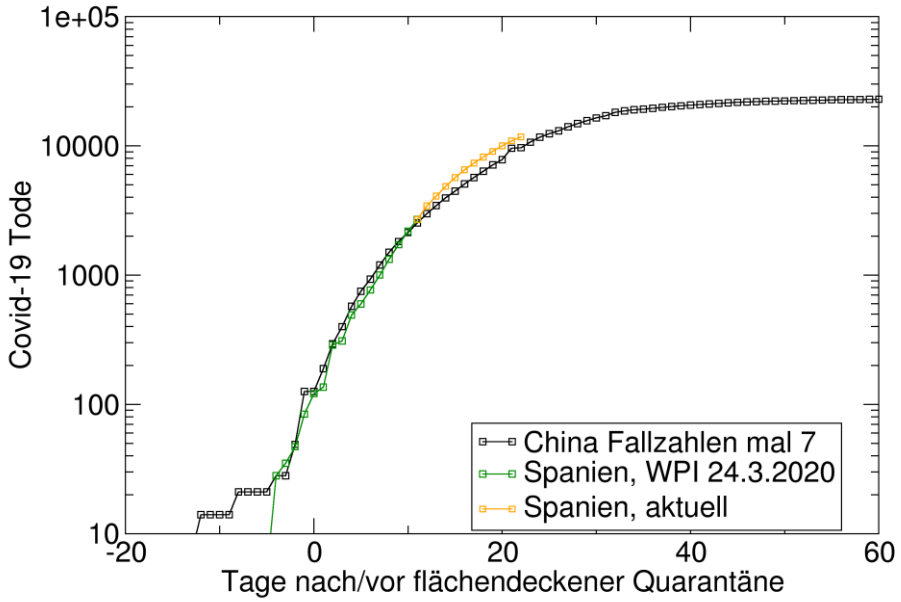


Diagramm 5c: number of deaths/day China vs Spain

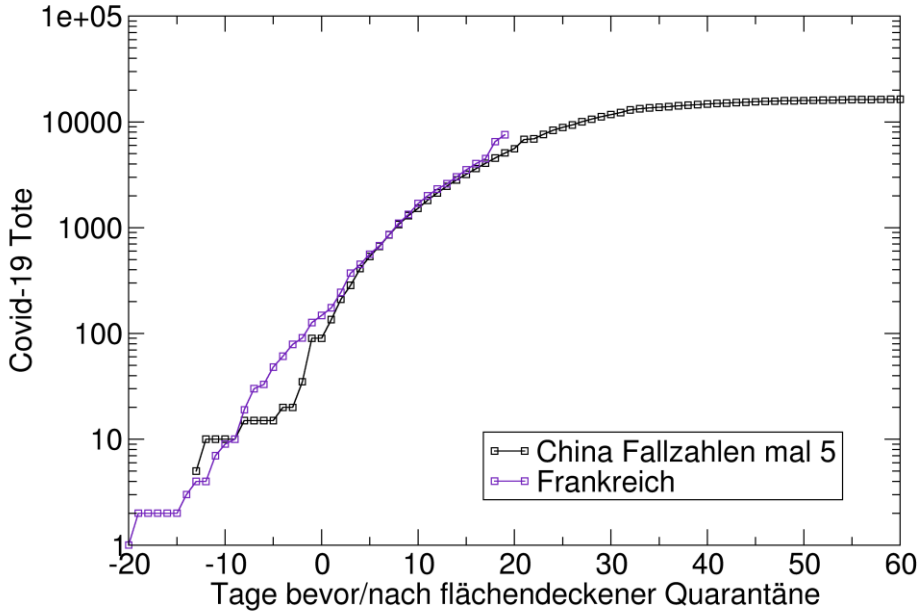


Diagram 5d: number of deaths/day China vs France

.

Correlation coefficients for the "death rates": quantification of correlation in the time series

The following diagrams show "correlation coefficients" between China (x-axis) and Italy (y-axis) for the "daily number of deaths" until a given day in the box, e.g. 12 (diagram 6a), as well as for the "total number of deaths until a given day", e.g. 12 (diagram 6b).

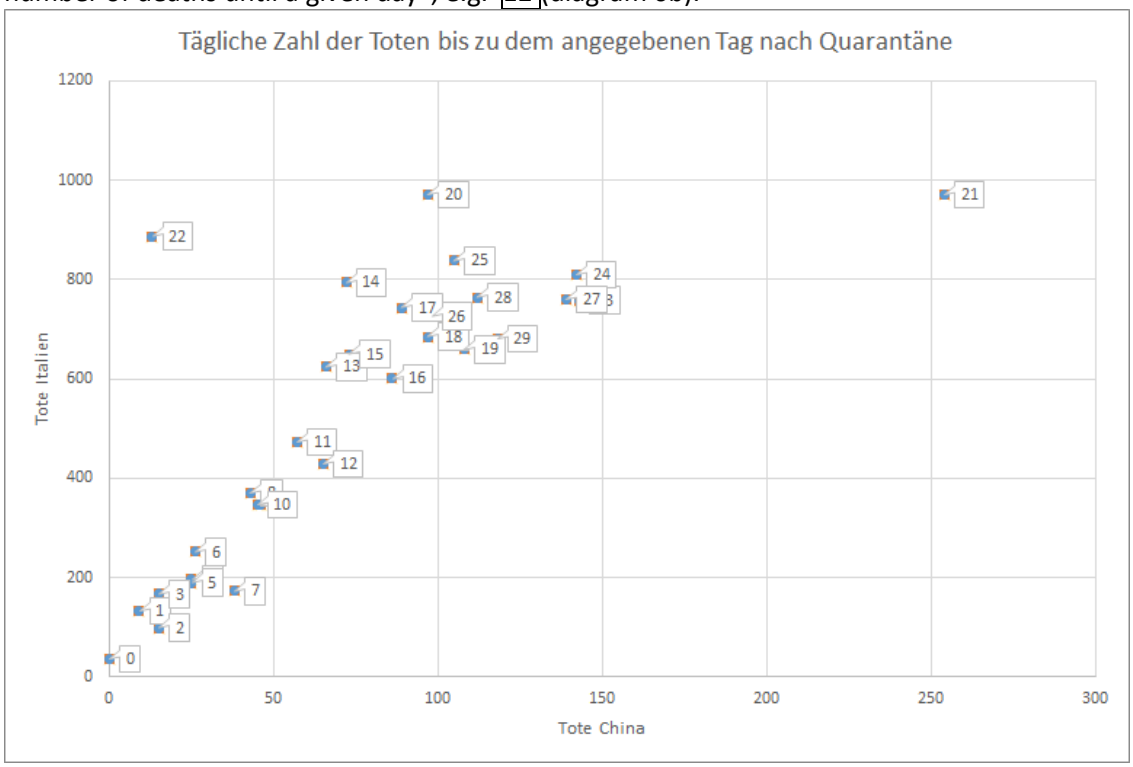


Figure 6a: Daily number of deaths: Correlation-coefficient (Pearson) = 0.76714076
p-value = 7.6048E-07

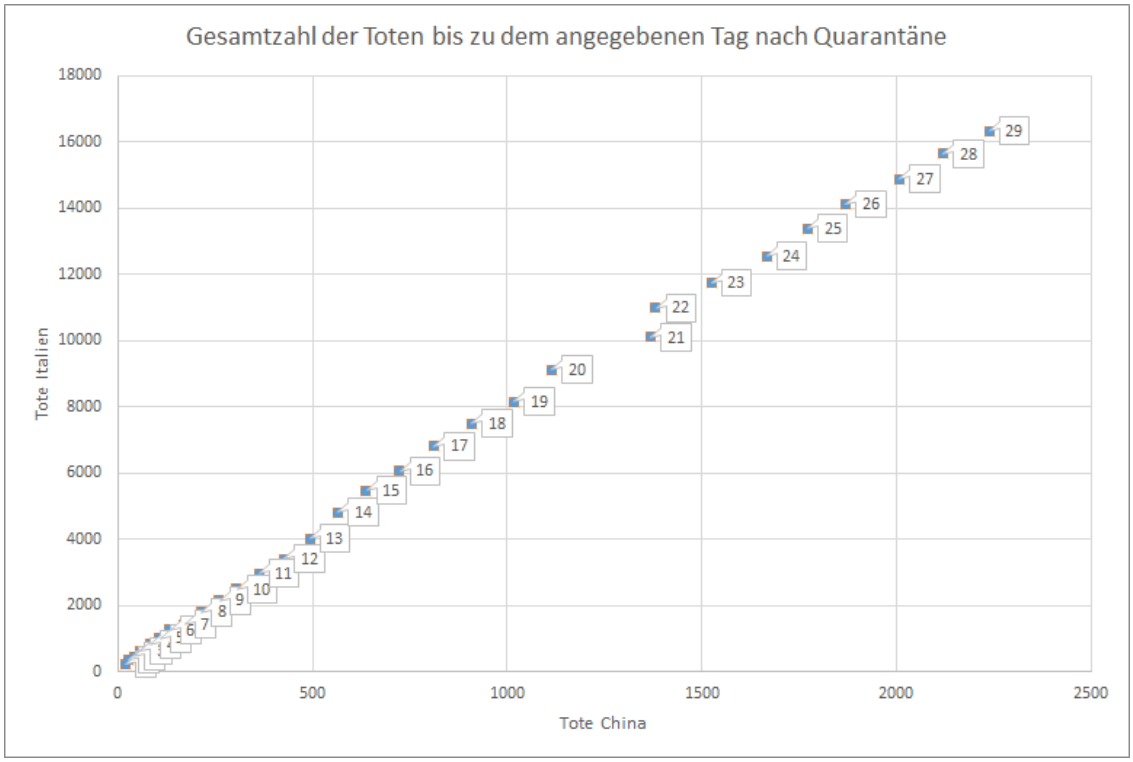


Figure 6b: Total number of deaths: Correlation-coefficient (Pearson) = 0.99856542
p-value = 3.7957E-37